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OTHER ENERGY SOURCES AND REDUCING AGENTS
AS SUBSTITUTES FOR COKING COALS
IN THE IRON AND STEEL INDUSTRY

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OTHER ENERGY SOURCES AND REDUCING AGENTS AS
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SUMMARY

INTRODUCTION:

Due to the fact that coking coals are becoming short and expensive while other sources of energy and reductants are becoming more abundant and cheaper, it is the aim of this paper to help towards finding a process that can use these sources and substitute the blast furnace. At the present, this will benefit the less developed areas but in the future it may benefit the whole world.

History and future of iron making:

From a survey of the history of iron making and its present state one can visualize its future. Iron will be produced through the gaseous reduction of fine iron ores using electric power as the source of energy. It is expected that in the not so distant future, electricity produced from water and atomic power will be the cheapest source of energy.

The position in UAR and some less developed countries:

There are some countries for which, having no coking coals it was difficult to establish an iron industry in their lands. The majority of these countries have, instead, other sources of energy and reducing agents, an example being the UAR.

(a) The position in UAR: In our country we have no coking coals, but we have low grade and non-coking varieties which can be gasified to produce a gas that can be used as a cheap fuel for electric power production, and as a gaseous reductant. We have also large amounts of waste petroleum gases which can be used for the same purposes with a cost competitive with that of coke. In the near future a tremendous amount of very cheap electric power will be available from the High Dam and the Kattara Depression projects. For our good fortune we have big iron ore reserves near the sites of these resources. If, for example, the electric power from the High Dam is used for hydrogen and energy production the cost of power and reductant per ton iron produced will be £ 3.5 which has to be compared with 12.5, the price of one ton coke in Egypt.

(b) The position in some other parts of the world: Huge reserves of natural and petroleum gases are found in the Middle East and some other parts of Asia and Africa. These reserves can be joined together by a net work of pipe lines which distributes the gas to the different countries of these continents; and through the help of the United Nations they can build up economic industries. Many countries contain non-coking and low grade coals which can be converted to useful gases by under-ground gasification or otherwise. All countries are trying to produce cheap electric power to help industrialization; cheap fuels and hydro-electric means are used while atomic power is coming into the picture.

Electricity and reducing gases versus coke:

Coke substitutes have the following advantages over coke:

- (a) The use of electricity is cleaner and simpler than the use of coke. It can be used for hydrogen production.
- (b) Hydrogen is the most powerful reductant; by using it the metal produced will be much cleaner than when using coke.
- (c) When using gases less flux is required and consequently less energy; productivity increases and lower grade ores can be used.
- (d) The process can be run acidic which is advantageous.
- (e) Oxygen produced, as a by-product, electrolytically during hydrogen preparation, can be used in the steel industry.

Research work:

- (a) Research work already carried out: The basic studies concerning this project were done in seven works during the period 1949 - 1959.
- (b) Research work going on: Three works deal with the technological aspects of the process while the other four concern the production of pure iron and steel from the reduced sponge.
- (c) The pilot plant stage: Work is being conducted on semi-pilot units while arrangements for the pilot stage are nearly complete.

The electrogen furnace process for iron production:

The principle of this process is based upon using gaseous reductants to produce molten iron from fine ores using electric power as the source of energy. It is a flexible, continuous, efficient process that can use any type or grade of ore. The furnace consists of three parts; the top where the ore is charged, dried, preheated, and partially reduced; the shaft where the reduction is almost complete by the time the particles fall from its top to its bottom; and the hearth where the reduced particles are smelted with the help of a flux to produce molten iron and slag. The hearth is an electric arc furnace.

The electrogen process versus other new processes of iron production:

After surveying the other new processes of iron production and their principles, a comparison was made between these processes and the electrogen process which showed, on scientific, technological and economic basis, the latter process to be the most reliable of all and even to be a **strong contestant** to the blast furnace process.

International cooperation in this field:

We invite, through the United Nations, all experts in this field to help us in the further development of this process, and we invite our neighbours and friends in the less developed areas to collaborate with us in the research work and pilot plant stage going on and to discuss with us the best way in our particular circumstances for developing the iron and steel industry in our countries.